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EFFECT OF BLANCHING AND PACKAGING MATERIAL ON THE COLOUR AND MICROBIAL LOAD OF BEN OIL (*MORINGA OLEIFERA*) LEAF POWDER

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ABSTRACT

Purpose: To investigate the effect of blanching and packaging materials on colour and storage stability of Ben oil (*Moringa oleifera*) leaf powder.

Design/methodology/approach: Fresh green Ben oil was blanched in a hot water (100°C) for 4 min, air dried, made into powder and packaged in glass, plastic and polyethylene. Stored at room temperature and analysed for colour and microbial loads. Colour was measured using Chroma meter (Colour-TEKPCL, USA) version.

Findings: Unblanched sample had lower *l** (Bright) colour value compared to blanched while blanched sample had a lower *a** (Green) colour value. *a** value of blanched dried sample stored in glass and plastic decreased but the value increased in polyethylene. Loads in samples increases more in plastic containers.

Practical implications: Blanching enhanced the brightness of the leave powder. Glass retained its colour and seems to be less permeable to microorganisms.

Value: This findings is valuable to Ben oil powder processors.

Keywords: Ben oil; blanching; colour; glass; polythene; brightness.

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INTRODUCTION

Green leafy vegetables constitute an indispensable constituent of human diet. In Africa, they are consumed as cooked complements to the major staples, like cassava, cocoyam, maize, rice and plantains (Oguntona and Oguntona, 1985) and they are valuable sources of nutrients especially in rural areas where they contribute substantially to protein, mineral, vitamins, fibre and other nutrients which are usually in short supply in daily diets (Mosha and Gaga, 1999).

Many of these leafy vegetables are common in all parts of Nigeria, but some are restricted in their natural distribution because of climatic factors. They are in abundance shortly after the rainy season but become scarce during the dry season during which cultivated types are used (Mosha and Gaga, 1999; Mepha et al., 2007).

Vegetables, if not pressured within few days after harvest will begin to decay. In an attempt at preserving these vegetables from decaying, drying as one of the oldest method of food preservation is often used (Kandall et al., 2006).

Ben oil (*Moringa oleifera*) leaf is the most widely cultivated species of monogeneric family, the Moringaceae, which is indigenous to South Asia, where it grows in the Himalayan an foothills from North Eastern Pakistan to Northern West Bengal, India (Sharma et al., 2011).

It is a perennial soft wood tree with timber of low quality, but which for centuries has been advocated for traditional medicinal and Industrial uses (Fuglie, 2001).

Ben oil leaf is the most nutrient rich plant yet discovered and it is an exceptional nutritious vegetable with a variety of potential uses; it provides a rich and rare combination of nutrients, amino acid, anti-oxidants, anti-aging and anti-inflammatory properties used for nutrition and healing (Johnson, 2005; Manzoor et al., 2007).

The dry leaves of *Moringa oleifera* leaves powder contain 7 times more Vitamin C than Orange, 10 times Vitamin A than carrot, 17 times calcium than milk, 15 milk potassium than banana, 25 times iron than spinach and 9 times protein than yoghurt (Fuglie, 2000, 2001).

Moringa leaves are vegetables that are easily damaged, so we need processing into dried form intended for the public, especially vulnerable groups, such as children, pregnant and lactating women to be stored for a long or applied more widely but in general, every step of the drying process, especially the blanching treatment, affect the characteristics of vegetables, whether desired or not (Titi Mutiara et al., 2013). Leaves can be eaten fresh, cooked or stored as dried powder for many months without refrigeration and loss of nutrition value (Donovan, 2007).

Blanching is a process in which vegetables are briefly exposed to boiling water prior to low temperature storage and serves as a necessary step to maintain vegetable quality and extend shelf life. Blanching not only inactivates enzymes and reduces the microbial load but also improves colour, texture and protein stability of the vegetables (Barrett and Theerakulkait, 1995; Lin and Schyvens, 1995). Three main blanching methods includes; boiling, steaming and boiling+sodium bicarbonate (Titi Mutiara et al., 2013). Earlier report revealed that blanching had a great effect on amino acids and scores of Moringa leaves and their digestibility (Titi Mutiara et al., 2013). Also, Yixiang et al. (2012) stated that both the textural and microbiological qualities of processed vegetables are influenced not only by variety and maturity at harvest, but by processing such as blanching and storage conditions as well.

Packaging maintains the benefits of food processing after the process is complete, enabling foods to travel safely for long distances and still be wholesome at the time of consumption.

The goal of food packaging is to contain food in a cost effective way that satisfies industry requirements and consumer desires, maintains food safety and minimises environmental impact (Marsh and Bugusu, 2007). Glass, polythene and different plastic containers with different properties are commonly used for packaging Ben oil leaf powder in Nigeria and some other countries. The powder is being packaged prior to use either as an addition to pap, water, soup and other food products for the purpose of its nutrients and health benefits.

Although different work has been done on Ben oil (*Moringa oleifera)* leaves such as the determination of its nutritional value, microbiological and Functional properties (Beth and Lindsay, 2005; Gernah and Sengev, 2011; Yang et al., 2006). Also, the effect of drying methods on the quality characteristics of Ben oil (*Moringa oleifera)* leaves powder has been investigated (Pallavi and Dipika, 2010).

However, colour plays an important role in processing and acceptability of food materials. Storage stability and shelf life of packaged food product are now receiving much attention. Little or no work has been done on the effect of blanching and packaging materials on the quality (most especially the colour) of Ben oil leaves powder.

Therefore, the objective of this research work was to investigate the effect of blanching and packaging materials on the colour quality and storage stability of Ben oil leave powder.

LITERATURE REVIEW

Properties of selected packaging material

Glass is odourless and chemically inert with virtually all food products glass has several advantages for food packaging applications. It is impermeable to gases and vapours, so it maintains product freshness for a long period of time without impairing taste of flavour. Glass is rigid, provides good insulation and can be produced in numerous different shapes. The transparency of glass allows consumers to see the product, yet variation in glass colour can protect light-sensitive contents (Marsh and Bugusu, 2007).

Plastics are made by condensation polymerization (polycondensation) or addition polymerization (polyaddition) of monomers unit (Marsh and Bugusu, 2007).

There are several advantages to using plastics for food packaging. Fluid and mouldable, plastics can be made into sheets, shapes and structures, offering considerable design and flexibility. They are chemically resistant and inexpensive and light weight. In fact many plastics are heat sealable, easy to print and can be integrated into production process where the package is formed, filled and sealed in the same production line (Marsh and Bugusu, 2007).

Polythene is of good chemical resistance ability, tough, light in weight and with low gas permeability compared to glass (Marsh and Bugusu, 2007).

MATERIAL AND METHODS

Source of material

Ben oil (*Moringa oleifera)* leaves used for this study was sourced from a local farm in Oke-Ata, Abeokuta, Ogun State. Other materials such as sterile glass, polythene and plastic were purchased from an open market in Kuto, Abeokuta, Ogun State Nigeria.

METHODOLOGY

Preparation of Ben oil (Moringa oleifera) leaves powder (Un-blanched)

The leaves of Ben oil (*Moringa oleifera)* were collected at a time from the same tree to avoid the effect of soil variation on the content of the leaves.

Bruised, decayed and wilted leaves were separated from fresh, green, undamaged and non-insect infected before washing the leaves, as decayed and wilted leaves give a bad flavour to the whole batch. The stalks of the leaves were cut from the main branches and the leaves were washed with water to remove all the adhering dust, dirt and particles. The leaves were then weighed and air dried using the method described by Pallavi and Dipika (2010).

Pretreatment of Ben oil (Moringa oleifera) leaf and drying

Blanching of the sample

The fresh green, undamaged and non-insect infected *Moringa oleifera* was blanched in a hot water at 100°C for about 4–5 min and then air dried.

Drying of Ben oil (Moringa oleifera) leaves

Air Drying

The method of Pallavi and Dipika (2010) was adopted. The blanched leaves were spread on sacks, kept in well ventilated room and away from sun. Natural current of air was used for the air drying. It took about six days for the leaves to dry completely and become crisp and brittle to touch.

Preparation of Ben oil leaf powder

Dried blanched and un-blanched leaves were made into powder with the aid of a blender. They were then packaged into sterile glass, plastic, polyethylene and then stored at room temperature prior to analysis.

Determination of the colour variation of Ben oil leave powder

The colour value of the resulting blanched and un-blanched dried Ben oil (*Moringa oleifera*) leaf powder was measured using chroma meter (Colour-TEKPCL, USA).

Determination of the microbial loads

The total plate count (microbial loads) of the resulting blanched and un-blanched dried samples were carried out using nutrient agar.

The sample was thoroughly mixed in order to have microorganism evenly distributed. 1.0 g of sample was homogenised in 9.0 ml sterile 0.1% peptone water for secs. (normal speed). This was serially diluted in sterile peptone water according to Olutiola et al. (1991). Serial ten fold dilutions of the bacterial suspension over a range were prepared. One dilution contain between 50 and 500 viable bacterial per ml. 9 mls of suffered saline was added to the 1st tube and 1 ml of the dilute buffered saline was added to the 2nd tube till the last (6th) tube. 1 ml of the bacterial suspension was also added into the test tube which was also mixed continuously till it gets to the 6th tube,

then 1 ml is discarded. This gives a dilution of 1/10, 1/20, 1/40, 1/80, 1/160, 1/320. 1 ml each dilution was pipette into sterile Petri-dishes and nutrient agar was poured over it. All media and dilutions used were sterile at the temperature of 121°C and pressure of 1.02 $kgcm^{-1}$ by autoclaving (Olutiola et al., 1991).

Total plate count was done by plating 1 ml aliquot samples on Plate Count Agar (PCA) and incubating at 30°C for 48 hr. Visually observed colonies were subsequently made by multiplying the number of colonies with the diluting factor to five number of bacterial per ml and recorded in colony forming unit per gram (Cfu/g) using the method of Fawole and Oso (1988) and Olutiola et al. (1991).

RESULT AND DISCUSSION

Results and discussion of l a* b* colour value of blanched and unblanched Ben oil powder at the initial stage*

The *l** value indicate brightness, *a** indicate greenness while *b** represent yellowness of leafy vegetables (Wikipedia, 2011). The result of *l**, *a**, *b** colour value of Ben oil (*Moringa oleifera*) leave powder at the initial stage is shown in Table 1. There are significantly different ($P < 0.05$) among all the evaluated samples in terms of *l**, *a**, *b** colour value evaluated.

Unblanched air dried sample (SB) had lower *l** colour value of 4018.00 while Blanched (HB) air dried Ben oil leave powder had higher *l** colour value of 4242.00. This sample was slightly dark in nature.

The most desirable colour of leafy vegetables is its greenish colour. The low *a** value indicate the green colour of the leaves (Yixiang et al., 2011; Wikipedia, 2011). The blanched air dried Ben oil leave powder had the lowest *a** colour value at the initial stage (106.00), this shows that this sample is the most greenish sample out of the prepared samples. The unblanched air dried Ben oil leave powder had an *a** colour value of 126.00.

The *b** colour value indicate or shows the yellow colour present in the leaves that shows as a result of absence of photosynthesis.

The *b** colour value in blanched and unblanched air dried Ben oil leave powders were 1596.00 and 1638.00.

Unblanched dried sample had lower *l** colour value compared to blanched dried that is, *l** value increased with pretreatment. Blanched Ben oil leave powder had a lower *a** colour value.

Table 1 The result of *l* a* b at initial stage of dried Ben oil (*Moringa oleifera*) leave powder**

Sample Code	*l**	*a**	*b**
Hu	4018.00^{b}	126.00^{a}	1638.00^{a}
HB	4242.00^{a}	106.00^{b}	1596.00^{b}

Source: Values are means of triplicate determination.

Means on the same column with different superscripts are significantly different ($P \leq 0.05$).

Note: Hu – Unblanched air dried sample; HB – Blanched air dried sample; *l** – Brightness; *a** – Greenness; *b** – Yellowness.

Results and discussion of l a* b* Colour value of Unblanched and Blanched Dried Ben oil powder stored in different Packaging Material*

The result of *l* a* b** colour value of unblanched air dried Ben oil leaves powder is as shown in Table 2. The unblanched air dried leaves of Ben oil leaves stored in glass had the lowest *l** value of 3464.50, this sample is the most darkest sample out of all, the sample stored in plastic has lower *l** colour values of 3635.50, the sample stored in polythene had the highest *l** value of 4552.00.

The *a** colour value of the unblanched shadow dried Ben oil leaves stored in plastic had the lowest value of 181.50, the value increases in plastic after storage when compared with the initial. Sample stored in the glass had lower *a** value of 186.00 but the sample stored in polythene had higher *a** colour value of 231.50.

The *a** colour value increases in all the samples when compared with the initial sample. The unblanched shadow dried Ben oil leaves stored in polythene had the lowest *b** value of 1639.50, indicating the yellow colour. The *a** colour value increases in glass and plastic with the values of 1954.00, 2046.50, respectively.

The *b** colour value increase in all the samples stored in all the packaging materials when compared with the initial sample.

Table 2 The *l* a* b colour value of stored unblanched air dried Ben oil leaves powder after two months of storage**

Sample code	*l**	*a**	*b**
Hu polythene	4552.00[a]	231.50[a]	1639.50[c]
Hu plastic	3635.50[b]	181.50[b]	2046.50[a]
Hu glass	3464.50[c]	186.00[b]	1954.00[b]

Source: Values are means of triplicate determination.

Means on the same column with different superscripts are significantly different ($P \leq 0.05$).

Note: Hu polythene – Unblanched air dried Ben oil leaves powder stored in polythene; Hu plastic – Unblanched air Ben oil leaves powder stored in plastic; Hu glass – Unblanched air Ben oil leaves powder stored in glass.

Results and discussion of l a* b* Colour value of blanched dried Ben oil powder stored in different packaging material*

The result of *l* a* b** colour value of blanched air dried Ben oil leaves powder stored in different packaging material after a month is shown in Table 3.

After two months, *l** value of blanched Ben oil leaves powder stored in plastic became lower than those stored in other packaging material (Table 3). This result shows that the *l** value decrease at storage in plastic containers.

The *a** value of blanched dried Ben oil powder stored in glass and plastic decreased but the value increased in polyethylene. These could be due to light transmittance ability of the packaging materials. The *b** colour increased in sample stored in plastic, while *b** decreased in others.

The *l** value of blanched air dried Ben oil leaves powder stored in the plastic, is lower than those stored in other packaging material, the blanched air dried Ben oil leaves powder stored in the glass also had a lower *l** value of 3353.00 but not as low as the sample stored in the plastic.

The blanched air dried Ben oil leaves powder stored in the polythene had the highest *l** value of 3611.50 when compared with other samples.

The blanched air dried Ben oil leaves powder stored in the glass had the lowest *a** colour value of 21.50, this is the most greenish sample out of all the samples.

Also the blanched air dried Ben oil leaves powder stored in the plastic had a lower *a** colour value of 40.00 which is still preferable but the sample stored in the polythene had the highest *a** colour value of 181.00.

The *a** value of air blanched dried Ben oil leaves powder stored in the glass and plastic fall but the value increased in polythene. The *b** value of blanched air dried Ben oil leave powder stored in polythene had the lowest value of 1512.50. The sample stored in the glass also retain the yellow colour of the leaves while the sample stored in the plastic had the highest *b** colour value of 1656.50. The *b** colour value increased in the sample stored in polythene while the *b** value decrease in other packaging material.

Table 3 The *l *a** *b** colour value of stored blanched air dried Ben oil leaves powder after two months of storage**

Sample code	*l**	*a**	*b**
NBI polythene	3611.50[a]	181.00[a]	1513.50[c]
NBI plastic	3249.00[c]	40.00[b]	1656.50[a]
NBI glass	3353.00[b]	21.50[c]	1580.50[b]

Source: Values are means of triplicate determination.

Means on the same column with different superscripts are significantly different ($P \leq 0.05$).

Note: NBI polythene – Blanched air dried Ben oil leaves powder stored in polythene; NBI plastic – Blanched air dried Ben oil leaves powder stored in plastic; NBI glass – Blanched air dried Ben oil leaves powder stored in glass.

Results and discussion of microbial loads of dried Ben oil powder at the initial stage

The result of the total microbial count on the air dried samples at the initial stage is as shown in Table 4. The result shows that the microbial load on the blanched sample was higher compared to the unblanched samples.

However, values obtained for the unblanched (25×10^{-1} cfu/g) and blanched samples (205×10^{2} cfu/g) were within acceptable limit when compared with the International Standard recommended limit of microbial contaminants for food ($<10^{6}$ cfu/g) (Anon, 1974).

Table 4 The total plate counts of unblanched and blanched dried Ben oil leave powder at the initial stage

Sample Code	*Initial value (cfu/g)*
HB	25×10^{-1}
NBI	205×10^{2}

Note: HB – Unblanched air dried Ben oil leaves powder; NBI – Blanched air dried Ben oil leaves powder.

Results and discussion of microbial loads of dried Ben oil powder stored in different packaging material

The result of the total microbial count on the air dried Ben oil leaves powder stored in different packaging material is as shown in Table 5. The result shows that the microbial loads on the

unblanched (25×10^{-1} to 103×10^{3} cfu/g) was lower compared to the loads on the blanched samples (205×10^{2} to 399×10^{3} cfu/g) in all the packaging material even after storage. Although, values obtained from the samples for all the packaging materials when considered after storage were within the acceptable limit when compared with the International Standard recommended limit of microbial contaminants for food ($<10^{6}$ cfu/g) (Anon, 1974), but glass material could be recommended among the packaging material since it shows it will be less permeable to microorganism if perfectly seal and could be good for storage. The result of the loads (low count) in glass after storage compared to other packaging material considered could be due to the characteristic of glass packaging material as lees permeable to external material. However, glass also has some disadvantage such as high cost, heavy and fragility, etc. (Marsh and Bugusu, 2007). All these disadvantages could limit the use of glass in the packaging of Ben oil leave powder. Polythene packaging material also shows less permeability to microorganism after storage in them. Polythene is not heavy, not expensive, not fragile and could be used easily conveniently to store and transport Ben oil leave powder compare to glass. However, the packaging of Ben oil leave powder could be recommended to be packaged in small quantity and well-sealed to minimise the problem of sealing after each use.

Table 5 The total plate count of stored blanched air dried Ben oil leaves powder after one month of storage

Sample code	*Initial count (cfu/g)*	*Count after four weeks (cfu/g)*	*Count After eight weeks (cfu/g)*
HB Polythene	25×10^{-1}	303×10^{-1}	499×10^{-1}
HB Plastic	25×10^{-1}	130×10^{2}	103×10^{3}
HB Glass	25×10^{-1}	101×10^{-1}	124×10^{2}
NBI Polythene	205×10^{2}	150×10^{3}	245×10^{3}
NBI Plastic	205×10^{2}	550×10^{2}	399×10^{3}
NBI Glass	205×10^{2}	255×10^{2}	231×10^{2}

Note: HB polythene – Unblanched air dried Ben oil leaves powder in polythene; HB plastics – Unblanched air dried Ben oil leaves powder in plastic; HB glass – Unblanched air dried Ben oil leaves powder in glass; NBI polythene – Blanched air dried Ben oil leaves powder in polythene; NBI plastic – Blanched air dried Ben oil leaves powder in plastic; NBI glass – Blanched air dried Ben oil leaves powder in glass.

CONCLUSION

Blanching enhanced the brightness of the leave powder. Sample stored in polyethylene had highest *a** colour value. The *a** and *b** colour value increased in unblanched stored in the packaging materials when compared with the initial. Sample stored in polyethylene had the lowest *b**. Glass followed by polyethylene containers retained best the colour of the leave powder and they appeared to be less permeable to microorganisms. Blanched leaf powder had the highest microbial load. After storage, the load increases in both polyethylene and plastic (which had the highest) while the one in glass decreases (in blanched samples).

The load in unblanched samples increases in all packaging materials but more in plastic container.

Glass is hereby recommended for the packaging of Ben oil leaves powder based on the result from this research as it retained best, the colour of the leaves powder and seems to be less permeable to microorganisms but for the purpose of the highlighted advantages of polythene over glass, polythene could be recommended.

REFERENCES

Anon (1974) 'Biological specification for food', *Principles and Specific Applications*, Canada: University of Toronto press, p.24.

Barrett, D.M. and Theerakulkait, C. (1995) 'Quality indicators in blanched, frozen, stored vegetables', *Food Technology*, Vol. 49, pp.62–65.

Beth, D. and Lindsay, C. (2005) *Moringa Leaf Powder*, Echo Technical, Note.

Donovan, P. (2007) '*Moringa oleifera.* The Miracle Tree', Available at: http:/www.naturalnews.com/022272.html.

Fawole, M.O. and Oso, B.A. (1988) *Laboratory Manual for Microbiology*, 1st Edition, Ibadan: Spectrum Book Ltd., pp.22–25.

Fuglie, L.J. (2000) 'The miracle Tree *Moringa oleifera*: Natural nutrition for the Tropics', p.172, Church world service, Dakar, p.68, revised in 2001 and published as the miracle tree: The multiple attributes of Moringa.

Fuglie, L.J. (2001) 'The Miracle tree: *Moringa oleifera*: natural nutrition for the tropic', *Traning Manual Church World Services*, Dakar, Senegal.

Gernah, D.I. and Sengev, A.I. (2011) 'Effect of processing on some chemical properties of the leaves of the drumstick tree (*Moringa oleifera*)', *Nigerian Food Journal*, Vol. 29, No. 1, pp.70–77.

Johnson, B.C. (2005) *Clinical Perspectives on the Health Effect of Moringa oleifera: A Promising Adjunt for Balanced Nutrition and Better Health*, Kos health publications, August.

Kandall, P., Dipersio, P. and Solos, J. (2006) 'Drying vegetables', Available at: http://www/extiolo-state.edu/PUBS/FOODNUT.

Lin, Z. and Schyvens, E. (1995) 'Influence of blanching treatments on the texture and color of some processed vegetables and fruits', *Journal of Food Processing and Preservation*, Vol. 19, pp.451–465.

Manzoor, M.F., Anwar, T.I. and Bhnager, M.L. (2007) 'Physico-chemical characterization of *Moringa concanensis* seeds and seeds oil', *Journal of American Oil chemists Society*, Vol. 84, pp.413–419.

Marsh, K. and Bugusu, B. (2007) 'Food packaging – roles, materials and environmental issues', *Journal of Food Technologist*, Vol. 72, No. 3.

Mepha, H.D., Eboh, L. and Banigo, D.E.B. (2007) 'Effect of Processing treatments on the nutritive composition and consumer acceptances of some Nigerian Edible Leafy vegetables', *African Journal of Food Agriculture Nutrition and Development*, Vol. 7, No. 1.

Mosha, T.C. and Gaga, H.E. (1999) 'Nutritive value and effect of blanching on trypsin and chymotrypsin inhibitor activities of selected leafy vegetables', *Plant Foods for Human Nutrition*, Vol. 54, pp.271–283.

Oguntona, T. and Oguntona, C.R.B. (1985) *Proximate Composition of Three Leafy Vegetable, Commonly in North-eastern Nigeria*, MSc (Biochemistry) Thesis, University of Ibadan. Nigeria.

Olutiola, P.O., Famurewa, O. and Sonntag, H.G. (1991) *Types of Media an Introduction to General Microbiology: A Practical Approach*, Heidelberger Verlagsanstalt Druckerei GmbH, Heidelberg, pp.48–50.

Pallavi, J. and Dipika, M. (2010) 'Effects of dehydration on the nutritive value of drumstick leaves', Department of Home Science, Internal College for Girls, Jaipur Rajastham, India, *Journal of Metabolomics and System Biology*, Vol. 1, pp.5–9.

Sharma, V., Paliwal, R., Pracheta, S. and Sharma, S. (2011) 'Phytochemical analysis and evaluation of antioxidant activities of hydro-ethanolic extract of *Moringa oleifera* Lam', *Pods Journal of Pharmacy Research*, Vol. 4, pp.554–557.

Titi Mutiara, K., Harijono, T.E. and Endang, S. (2013) 'Effect of blanching treatments against protein content and amino acid drumstick leaves (*Moringa oleifera*)', *Journal of Food Research*, Vol. 2, No. 1.

Wikipedia (2011) Available at: www Wikipedia Dictionary Com.

Yang, R.Y., Tsou, S.C., Lee, T.C., Chang, L.C., Kuo, G. and Lai, P.Y. (2006) 'Moringa, a novel plant rich in antioxidants, bioavailable iron and nutrients', *A Report from the Conference Proceeding On Moringa and Other Highly Nutritious Plant Resources; Strategies, Standards and Markets for a Better Impact on Nutrition in Africa*, Held in Accra, Ghana, 16–18 November 2006, pp.224–239.

Yixiang, X.U., Edward, S., Steven, P., Laban, R., Cory, G. and Shuxin, R. (2012) 'Textural and microbiological qualities of vegetable soybean (Edamame) affected by blanching and storage conditions', *Journal of Food Processing and Technology*, Vol. 3, p.6.

BIOGRAPHICAL NOTES

Omobolanle Olorode holds a Master degree in Food Processing and Technology and Bachelor of Food Science and Technology degree from Federal University of Agriculture, Abeokuta, Nigeria. She has successfully authored and coauthored over ten Scientific Journals. Attended and presented quality papers at relevant conferences (National and International). She has a lecturing experience of almost seven years. She is a professional member of six academic Organizations including Institute of Food Technology, (USA) and OWSD. Currently, she is a doctoral student at the Federal University of Agriculture, Abeokuta, Nigeria. Her area of specialisation is processing, sensory evaluation and packaging of food products.

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Raji Oluwatoyin holds a Master degree in Industrial Microbiology from University of Ibadan, Nigeria and BSc in Microbiology from obscene Awolowo University, Ile-Ife, Nigeria. She has successfully published quality Scientific Journals. Attended and presented quality papers at relevant conferences. She is a professional member of Academic Organizations and currently running her PhD at the University of Ibadan, Nigeria. She lectures Microbiology related courses in Moshood Abiola Polytechnic, Abeokuta, Nigeria.